Case Study

PRECISION MEDICINE

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Precision medicine encompasses predictive, preventive, personalised and participatory medicine (also termed P4 medicine)[1]. It is moving from the traditional one-size-fits-all form of medicine to more preventative, personalised, data-driven disease management model that achieves improved patient outcomes and more cost-efficiencies. Precision medicine, as defined by the National Institute of Health (NIH), is an emerging approach for disease treatment and prevention that considers individual variability in genes, environment, and lifestyle[2]. The promise is that precision medicine will more accurately predict which treatment and prevention strategies will work best for a particular patient.

There are, however, significant challenges to the widespread adoption of precision medicine that include a deluge of medical data, a paucity of trained specialists, and the enormous costs of drug development[3]. Take, for example, the 30% rise in the number of CT scans ordered in the UK between 2013 and 2016[4] during which period the number of radiologists only increased by 3% annually[5]. Many studies demonstrate that as radiologists are compelled to work faster their interpretation error rate rises[6].

However, AI can address this by leveraging deep learning approaches to overcome the obstacles inherent in large data sets and unstructured data. In clinical settings, AI can assist clinicians to work more efficiently and make more accurate diagnoses improving the productivity of healthcare workers.

In the broader setting, AI is helping industry to accelerate drug development, cut costs and gain faster approvals while reducing errors. According to a recent research report[7], achieving the full potential of precision medicine will be impossible without applying AI and machine learning. Specifically, leveraging advanced machine learning and deep learning technology can outperform clinicians and researchers in rapidly analysing large datasets and integrating exponentially growing amounts of data from a wide variety of novel -omics sources (e.g. genomics, transcriptomics, proteomics, metabolomics, microbiomics) into clinically actionable insights

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for personalised care plans and more effective population health management.

One challenge is how best to integrate precision medicine data into electronic health records (EHR). OSF HealthCare, an integrated healthcare network, has integrated CancerIQ's genetic cancer risk assessment program with Epic's EHR platform as part of a system-wide population health initiative to reduce cancer disparities and deaths[8]. In the US, individuals can now leverage Medfusion's national health data network to consolidate their health records and help drive discovery through private, secure data sharing using LunaPBC part of LunaDNA, the first community-owned genomic and health data platform – that enables members to access their EHRs[9].

AI and machine learning are already transforming precision medicine delivery by driving computational phenotyping tools (www.mendelian.co) and new methods for target drug discovery (e.g. BenevolentAI). In fact there are now 100s of start-up companies using AI in drug discovery,[10] demonstrating the power of this emerging sector for driving innovation in healthcare.

In clinical trials, fewer than a third of all phase II compounds make it to phase III, and one-third of phase III trials fail because the trial lacks enough patients or the right kinds of patients. AI can potentially boost the success rate of clinical trials by identifying and characterising patient subpopulations best suited for specific drugs and by efficiently measuring biomarkers that reflect the effectiveness of the drug being tested. Nevertheless, we are still at the proof-of-concept stage but feasibility pilot studies are demonstrating the high potential of numerous AI techniques for improving the performance of clinical trials.

Data-driven health will also likely impact patients directly by providing access to their own personal data, improving compliance with treatments and real time monitoring for adverse events making participation in P4 medicine a reality.